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[COMMITTEE PRINT]

# SCIENTIFIC MANPOWER AND EDUCATION

## Deficiencies in the Tabulation and Study of Scientific Manpower

## REPORT

OF THE

## COMMITTEE ON SCIENCE AND ASTRONAUTICS
## U.S. HOUSE OF REPRESENTATIVES

EIGHTY-SIXTH CONGRESS

FIRST SESSION

[No. 28]

----------, 1959

Printed for the use of the Committee on Science and Astronautics

UNITED STATES
GOVERNMENT PRINTING OFFICE
45582 WASHINGTON : 1959

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## LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
*Washington, D.C., August 21, 1959.*

Hon. OVERTON BROOKS,
*Chairman, Committee on Science and Astronautics.*

DEAR MR. CHAIRMAN: I am forwarding herewith for committee consideration a report on "Deficiencies in the Tabulation and Study of Scientific Manpower," prepared by Philip B. Yeager in collaboration with other members of the staff.

The report follows a period of committee inquiry, extending from February through June 1959, into the general problems of scientific manpower and education, plus a special examination of current efforts to keep track of the Nation's scientific and technical personnel. It complies with the directive of the full committee on August 6, 1959, to prepare such a report together with a committee resolution covering the immediate problem.

CHARLES F. DUCANDER,
*Executive Director and Chief Counsel.*

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# SCIENTIFIC MANPOWER AND EDUCATION

## Deficiencies in the Tabulation and Study of Scientific Manpower

### Introduction

On February 25, 1959, the Committee on Science and Astronautics began a series of hearings designed to acquaint members with the status, needs, and problems of the Nation's scientific manpower and education.

The hearings were extensive, running intermittently through May 1959. More than 30 expert witnesses appeared.

At that juncture the committee paused to evaluate the information presented to it and, on the basis of testimony thus far received, one major area of the scientific manpower problem appeared to warrant immediate attention. This was the problem of keeping track of the Nation's scientific and technical personnel, of knowing who these people are, where they are, what they can do. The hearings had disclosed that there is no place nor any organization which has comprehensive up-to-date information covering all scientific and technical personnel.

Consequently, the committee held additional hearings in June, inquiring further into current programs for tabulating and studying the scientific and technical manpower of the United States. Additional witnesses, specialists on the subject under inquiry, appeared before the committee; additional information was filed with the committee staff; reports on the subject which had been conducted by other groups in the near past, official and semiofficial, were studied.

It became clear to the committee that the Government's present efforts to create a useful census of scientists, engineers, and technicians—efforts being coordinated by the National Science Foundation under its 1950 charter—needed a substantial boost.

The chairman of the committee thus introduced on June 26, 1959, H.R. 7981, a bill which would have provided for a special ad hoc interdepartmental commission in the executive branch to review the entire problem and report its findings and recommendations back to the Congress. However, at a meeting of the committee on August 6, 1959, it was decided that a more immediate approach should be followed. The committee approved a resolution requesting the National Science Foundation to consult with all executive agencies concerned with the matter and report its findings and recommendations back to the committee by the beginning of the 2d session of the 86th Congress in January 1960.

The resolution is as follows:

COMMITTEE RESOLUTION ON THE TABULATION AND STUDY OF SCIENTIFIC AND TECHNICAL MANPOWER

Whereas the National Science Foundation Act of 1950 contains the following directive: "The Foundation is authorized and directed * * * to maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information covering all scientific and technical personnel in the United States, including its Territories and possessions"; and

Whereas the legislative history of the act shows that Congress attached high urgency to this matter; and

Whereas testimony before the committee indicates that Congress' directive has not been adequately implemented thus far and that this fact has been recognized by the National Science Foundation as well as other executive agencies and private organizations; and

Whereas testimony before the committee suggests that the register of scientific and technical personnel and its companion manpower studies have not been allowed the priority granted to other programs of the National Science Foundation; and

Whereas nearly a decade has gone by since the National Science Foundation was created and charged with responsibility in this general area; and

Whereas the world situation today makes an effective tabulation of scientific and technical manpower more critical than at any time in the history of the country: Now therefore be it

*Resolved*, That the Committee on Science and Astronautics of the House of Representatives request the National Science Foundation to submit to the committee on or about January 4, 1960, a comprehensive report covering (A) the status of the scientific and technical manpower register and the scientific manpower studies, and (B) the projected plans for the future, short-range and long-range, in these areas.

That in the preparation of this report the National Science Foundation should consult with other interested agencies of Government, including the Department of Commerce, the Department of Labor, the Department of Defense, the Department of Health, Education, and Welfare, the Civil Service Commission, the National Aeronautics and Space Administration, the Office of Civil and Defense Mobilization, the Selective Service System, and the Central Intelligence Agency, and include in its report summaries of the specific interests, needs, and recommendations of such agencies.

That in the preparation of this report, the National Science Foundation should seek the advice and assistance of the Federal Council for Science and Technology and of such private organizations as may be deemed appropriate.

That the National Science Foundation, in submitting the report, should indicate—

(a) How the Foundation proposes to secure appropriate information on both the formal training of scientific and technical personnel and their subsequent experience;

(b) What type and kind of information an effective register could most advantageously supply and should be expected to provide;

(c) In what manner and through what means such a record may best be maintained;

(d) The pertinent findings and recommendations of the Foundation itself following evaluation of information produced by this study.

That in making any recommendation to the committee, the National Science Foundation should include, among other things, the following:

(1) The probable cost of any recommended program, including the cost of maintenance and of adequate methods for keeping the program current.

(2) The estimated length of time which may be required to place an improved scientific and technical manpower tabulation program in operation.

(3) Whether the best results could be expected through compulsory or voluntary means.

(4) What agency of Government should bear responsibility for the program, and whether that responsibility should be exclusive or merely primary.

(5) What agencies of Government should be expected to cooperate with the agency responsible for the program and the manner in which such cooperation should be carried out.

(6) What amendments, if any, to laws now affecting scientific and technical manpower tabulations or registers should be made.

AUGUST 6, 1959.

## BACKGROUND

The very great importance of keeping track of scientific and technical personnel became evident around 1939–40 as the war clouds of World War II gathered. By that time the world was becoming aware that mere manpower and resources were no longer sufficient for the security of any nation. Scientific know-how had become another requisite.

In 1940, however, the United States had no census of scientists and technicians, as such. Hence it was necessary for the President to promulgate the establishment of a "National Roster of Scientific and Specialized Personnel," with the hope that such a roster would develop reasonably complete information on the identity, whereabouts, and experience of scientists who had particular skills necessary to the prosecution of the war effort. In June 1940, the roster was placed under the direction of Dr. Leonard Carmichael, then president of Tufts College and now Secretary of the Smithsonian Institution. Eventually more than 1 million persons were registered. The Selective Service System worked closely with the roster in efforts to guide specialists into areas where they would be most useful. These efforts sometimes failed spectacularly, but on the whole the arrangement was a notable improvement over previous ones improvised during emergency periods.

By the end of World War II, national emphasis on science reached a new high. Significant advances, particularly in the fields of electronics and atomic energy, assured a highly prominent role for the scientist, engineer, and technician in the future, not only in the world of commerce but in the conduct of the affairs of Government.

It was in this atmosphere that the Congress, as early as 1945, began consideration of the establishment of a Federal science agency, part of whose function would be to maintain a continuing record of the Nation's scientists, engineers, and technicians.

The history behind the "National Register of Scientific and Technical Personnel," as operated today by the National Science Foundation, is best described by these excerpts from a legislative study done within the Foundation in February 1958:

> The two provisions of the National Science Foundation Act of 1950[1] which relate to and provide the basis for the national register of scientific and technical personnel are as follows:
>
> "SEC. 3. (a) The Foundation is authorized and directed—
>
> "(8) To maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information concerning all scientific and technical personnel in the United States, including its Territories and possessions.
>
> "SEC. 14. (i) The National Roster of Scientific and Specialized Personnel shall be transferred from the United States Employment Service to the Foundation, together with such records and property as have been utilized or are available for use in the administration of such roster as may be determined by the President. The transfer provided for in this subsection shall take effect at such time or times as the President shall direct."
>
> * * * * * * *
>
> Briefly stated, the record shows that a register provision was included in the very first bill to bear the title "National Science Foundation Act" introduced in

[1] Public Law 507, 81st Cong., 2d sess.

December 1945. This first provision was substantially the same as that which became law in 1950, there being only four differences, two minor and two significant. Furthermore, the register provision appeared in every one of the dozens of Foundation bills, without exception in both Senate and House, throughout the entire 5 years of the turbulent history of the effort to pass a National Science Foundation Act. The same is true of the provision for transfer of the national roster to the Foundation, except that this provision appeared originally in the second bill rather than the first.

There were many references to the register throughout the 5 years, all favorable except for a challenge in 1950. But even here the challenge, which was brief and unsuccessful, was directed at who should maintain the register rather than against the concept of maintaining it.

*Origin of register provisions in 1945 and 1946*

The first bill to bear the title "National Science Foundation Act" was S. 1720, introduced by Senator Kilgore on December 21, 1945, during the last days of the 79th Congress, 1st session. This bill included the following:

"SEC. 7. The Administrator shall maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information concerning all scientific and technical personnel in the United States and its possessions. No individual shall be listed in such register without his consent."

This was the first provision for a Foundation register to appear in any bill. It will be noted that the basic wording is virtually identical with that included 5 years later in the act of 1950. There are only four differences: (1) The original "The Administrator shall maintain" later became "The Foundation is authorized and directed to maintain"; (2) "in the United States and its possessions" became "in the United States, including its Territories and possessions"; (3) the second sentence, "No individual shall be listed in such register without his consent," was deleted; and (4) the register section, which in 1945 was paired with the section on scholarships and fellowships in about the middle of the bill, was moved up in the act of 1950 to a place in section 3 among the eight basic functions of the Foundation.

Two months later, on February 21, 1946, in the 79th Congress, 2d session, Senator Kilgore introduced a new and somewhat revised bill, S. 1850. This included precisely the same section 7 providing for a register. It also contained a provision for transfer of the old national roster to the Foundation. * * *

The Senate committee report on S. 1850 contains the first substantive congressional comment concerning the register:

"The experience of war agencies has demonstrated the importance of placement facilities for scientific personnel. The success and usefulness of the national roster of scientific and specialized personnel and of the Office of Scientific Personnel suggest that the Foundation should maintain an up-to-date register of trained personnel which would be particularly useful—

"(1) In meeting the personnel needs of its own programs.

"(2) In placing the scientific personnel trained through the Foundation's programs of scholarships and fellowships.

"(3) In selecting scientific personnel to meet the Nation's need in time of war or other national emergency."

On the Senate floor there was much discussion of S. 1850 on July 1, 2, and 3 and many of its features were debated vigorously, but there was no objection to or discussion of the register provisions. On July 3 the bill was passed by the Senate.

In the House of Representatives the first bill introduced was H.R. 6448 by Congressman Mills of Arkansas. Also introduced was H.R. 6672 by Congressman Celler. Each included precisely the same wording as S. 1850 concerning the register. But there was no House committee report and no floor comment on the register provisions. The House did not pass either of these bills "because the pressure of legislative business at the close of the session was such that the House adjourned before it could take action."

*Passage and veto in 1947*

During the 80th Congress, 1st session, two competing bills were introduced in the Senate on February 7, 1947, S. 525 by Senator Thomas and S. 526 by Senator Smith. Each contained precisely the same register provisions as in S. 1720 of 1945 and S. 1850 of 1946 quoted above. The Senate committee reported favorably on S. 526 and made the following comment concerning the register in its report:

"In order to maintain a record, in case of future need, of scientific and technical personnel, and in order to assure the optimum utilization of such personnel,

the Foundation is to maintain a register of such men and to act as a central clearinghouse for information concerning them. No charges of regimentation can validly be made, since the bill expressly provides that no individual shall be listed in this register without his consent."

* * * * * * *

After 5 days of debate the Senate passed S. 526, the vote being 79 to 8 with 8 not voting. As passed, the bill contained the register provisions, without change and without comment other than quoted above.

In the meantime on February 10, 1947, three bills identical with S. 526 had been introduced in the House, H.R. 1815 by Congressman Case, H.R. 1830 by Congressman Mills, and H.R. 1834 by Congressman Priest, and on February 18 a fourth was introduced by Congressman Hays, H.R. 2027. An earlier bill, H.R. 942, was also considered. The bill finally reported out by the House committee on July 10, 1947, was H.R. 4102, introduced by Congressman Wolverton of New Jersey. This bill contained the same wording providing for a register, in section 10(b). The only comment concerning this section in the House committee report was as follows:

"By subsection (b) the Foundation is directed to maintain a register of scientific and technical personnel, but no individual may be listed in such register without his consent."

The bill was discussed in detail on the House floor on July 16, but without reference to the register, and passed on the same day.

* * * * * * *

On August 6, 1947, President Truman pocket vetoed the bill for several reasons, the principal one being that a Board of part-time officials would be given control, including selection of the Director, which would prevent the President from effective exercise of his constitutional duty of controlling the execution of the law. He did this with regret, being otherwise in favor of the bill. This Presidential message made no reference to the register provisions.

*Reports and discussion in 1948; deletion of "without consent" clause*

During the 80th Congress, 2d session, the only event of interest with respect to the register was the dropping of the last sentence in the provision which had remained unchanged since 1945: "No individual shall be listed in such register without his consent." The revised section then read as follows:

"The Foundation shall maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information covering all scientific and technical personnel in the United States and its possessions."

The one-sentence provision was included in S. 2385, which was introduced on March 25, 1948, by Senator Smith jointly with seven other Senators. This bill was reported favorably by a Senate committee on April 20, the report containing the following minimum reference to the register: "A roster of scientific personnel is to be maintained." An equally brief mention of the transfer of the national roster to the Foundation was made on page 5 of the same report. The Senate discussed this bill intensively on May 3, 4, and 5; made some amendments (none affecting the register); and passed it by voice vote on May 5, 1948.

In the meantime Congressman Priest had introduced H.R. 4852 on January 6, containing the same one-sentence provision for a register and the usual provision for transfer of the national roster. On March 25 Congressman Wolverton introduced H.R. 6007 which was reported June 4, accompanied by House Report No. 2223, including these register provisions. This bill failed to reach the House floor, so no legislation reached the President.

*Bills and reports in 1949; increased status for the register*

Senator Thomas introduced S. 247 on January 6, 1949, jointly with six other Senators (Kilgore, Fulbright, Magnuson, Smith, Cordon, Saltonstall). It included the one-sentence register provision and the usual provision for transfer of the roster to the Foundation. On March 3 a favorable report was submitted, including minimum reference to the register section: "A roster of scientific personnel is to be maintained." A similar minimum mention of transfer of the roster was made on page 7.

In the House seven bills were introduced. Four (H.R. 12, 185, 311, and 2751) were identical with the H.R. 6007 which had been favorably reported the preceding year. Two (H.R. 1845 and 2308) were identical with S. 247 mentioned in the preceding paragraph. One (H.R. 359) differed substantially from all the others, incorporating provisions rejected in previous years. The first six of these bills included the one-sentence provision for maintaining a register, and the usual

provision for transfer of the roster. H.R. 359, however, reverted to 1947 by including the sentence, "No individual shall be listed in such register without his consent."

The House committee reviewed these seven bills and all the testimony of the preceding 4 years, then drafted a new bill, H.R. 4846, which was introduced by Congressman Priest on May 24, 1949. "The committee believes that H.R. 4846, as amended, is a better bill with respect to form, as well as content, than any bill on the subject heretofore proposed, and that it meets the objections expressed by the President in his (veto) memorandum of August 6, 1947, with respect to S. 526."

With respect to the register, a significant change had indeed been made, clearly increasing its status. Up to this point the provision for maintenance of a register had been, since 1945, invariably linked to the section or subsection concerning scholarships and fellowships, and located (usually as about section 9 or 10) about midway in the bill. Now the register was moved up to section 3, following only the enacting clause and the establishment clause, and was made one of the eight basic functions of the Foundation. Two slight changes in wording were concurrently made: (*a*) instead of "The Foundation shall maintain a register * * *" the mandate was changed to read "The Foundation is authorized and directed—to maintain a register * * *"; and (*b*) instead of "* * * in the United States and its possessions." the wording was changed to "* * * in the United States, including its Territories and possessions."

* * * * * * *

Neither the House bill nor the Senate bill reached the floors of Congress during 1949, so no National Science Foundation legislation was passed that year, but H.R. 4846 had laid the basis for successful enactment the following year.

*The register in 1950*

The Senate had passed S. 247 on March 18, 1949, during the first session of the 81st Congress and allowed it to stand during the early part of the second session while the House considered similar legislation. During this second session in 1950 nearly all of the floor discussion was in the House. * * *

*Final enactment in 1950*

On March 1, 1950, the House passed H.R. 4846 by a vote of 247 to 126. They then immediately substituted the contents of this bill for S. 247, by voice vote, and sent it to the Senate.

On March 27, 1950, the Senate disagreed with the House substitution and appointed conferees (Senators Thomas of Utah, Murray of Montana, Lehman of New York, Taft of Ohio, and Smith of New Jersey). On the next day the House also appointed conferees (Congressmen Priest of Tennessee, Biemiller of Wisconsin, and Wilson of Oklahoma).

The conferees presented their report to the House on April 27 (H. Rept. No. 1958). In general the House provisions had prevailed, but a few changes had been worked out in conference. Since both the House and Senate revisions contained the same register provision, there was no discussion of the register. The Senate-House conferees had agreed unanimously, and after some discussion the House passed the amended bill (S. 247) by voice vote.

The Senate considered the same report on the following day and after brief discussion passed the same bill by voice vote.

On May 10, 1950, the bill was signed by the President and became law.

## Stewardship of the Science Foundation

The National Science Foundation thus did not really swing into operation until 1951, at which time it inherited the old "Roster of Scientific and Specialized Personnel." The roster appears to have been, by that time, badly out of date and difficult to handle. However, it was a start, and it represented some experience in the field on which the Foundation might draw.

Difficulties which the Foundation faced have been described to the committee by Dr. Harry C. Kelly, Assistant Director for Scientific Personnel and Education:

> Our most serious obstacle, however, during the early 1950's, in our efforts to understand our scientific manpower and training needs, was the lack of adequate

information. Estimates, in 1950, of the number of scientists and engineers in the country were based upon bits and fragments of information. No organized or sustained effort had been made to find ways to measure either current or long-range need.

Not until 1947–48 was there a general report on the number of college degrees granted in all the separate fields of science and engineering per year. No general survey had provided adequate information on the employment of our scientists and engineers in industry, education, and government. There were some scattered efforts to piece together some knowledge and understanding of the professional characteristics of our scientists and engineers, but they were poorly supported and fell far short of our actual needs.

At the beginning of this decade, we had very little idea of the nature and magnitude of the problems in science education which lay ahead. Furthermore, even though we had become acutely aware of the growing threat of the U.S.S.R., there had been only a rudimentary effort to make provisions for the utilization of our scientific and technical manpower resources in the event of national emergency or war.

Not only were we seriously hampered in those years by the lack of information needed for planning the nature and optimal size of our program approaches to education in the sciences, we were faced, also, with a general attitude of apathy toward support of the means to collect this information.

At present the National Science Foundation is undertaking to fulfill its 1950 congressional mandate to keep track of scientists and technicians and provide information concerning them through two main channels:

(a) Scientific manpower studies.

(b) The register of scientific personnel.

These particular endeavors, together with their objectives, were described to the committee by Dr. Kelly as follows:

This general legislative mandate we have translated into four principal objectives as guidelines to us for the program.

1. Provision of data regarding the supply, utilization, characteristics, training, fields of specialization of and demand for scientific and technical personnel so that the Foundation may consider relevant factors of scientific personnel resources in the development of its programs and as advisory to other Federal and non-Federal agencies.

2. The provision of a central clearinghouse for scientific manpower information so that other Government agencies, professional societies, private organizations, and others concerned with scientific and technical personnel may have access to information required for administering their programs.

3. Maintenance of the National Register of Scientific and Technical Personnel so that scientists and engineers with highly specialized skills may be identified, located, and placed in priority assignments if emergency conditions require it.

4. Administration of a limited program of research in order to sharpen and improve our methods for measuring demand, supply and characteristics of scientific personnel, and to develop a better understanding of the institutional framework in which scientists and engineers are employed.

This operation is under the direction, in our division, of Mr. Thomas Mills, who leads the unit, scientific manpower studies, sometimes called the clearinghouse.

It is largely concerned with a compilation and analysis of information. Its activities, include information on the supply, needs, characteristics, utilization, training, and so forth of scientific and technical personnel, and provision for release in useful forms for program and planning guidance.

The other unit, the National Register of Scientific and Technical Personnel, is concerned with the registration of scientists and engineers, the processing of this information to make it readily available, and the servicing of requests for information on scientific personnel included in the register.

It is our expectation that a third unit will be added to this program in the near future. This unit will be concerned with research into concepts underlying scientific manpower data collection and improvement of methods of securing such information.

Generally, the Foundation's scientific manpower studies are based upon information collected by other organizations, both private and public. This involves the review and analysis of materials originally collected by such agencies as the

U.S. Office of Education, Bureau of Labor Statistics, Bureau of the Census, National Research Council, and many others concerned with one or more aspects of scientific manpower.

The review of scientific personnel information provided through these other organizations frequently reveals certain data deficiencies. This is not to imply necessarily faulty workmanship on the part of these organizations, but rather to emphasize that these data are usually collected as a small part of a larger whole in which scientific personnel information is incidental. As these inadequacies become apparent, the scientific manpower studies program undertakes to secure better information. This may require direct collection or assistance to other organizations in their collection efforts. Each of these methods has been used on occasion.

*Register statistics*

According to information provided the committee the National Science Foundation estimates, on the basis of its definitions, that there are about 212,000 physical scientists in the United States and about 75,000 life scientists—a total of close to 300,000. The Foundation estimates there are roughly 850,000 engineers in the United States. It believes that it may be in error by as much as 10 percent in either direction on these figures.

Of such personnel, Foundation witnesses testified that present information, collected in 1957 and 1958, covers a total of 170,000 scientists of all types—plus a "finders list" of about 20,000 key engineers.

*Budget allocations*

Due to changing methods of accounting, it is difficult to obtain a fully accurate historical picture of the budgetary importance which the National Science Foundation gives to its scientific register and manpower studies. However, data provided the committee in regard to Foundation appropriations and obligations over the past few years does not suggest that this facet of the Foundation's work has gained stature within the overall budget.

In fiscal 1960, for example, the Foundation contemplates $400,000 for its register—which is 0.0025 of its Administration-approved budget of $160,300,000. This is somewhat less proportionately than the $381,000 for fiscal 1959—which was 0.0028 of a $134 million appropriation. The same trend shows up concerning the entire register-manpower studies budget. That is, the $1 million allocated for 1960 is 0.0062 of the 1960 appropriation, while 1959's allocation of $860,000 was 0.0064 of the total Foundation appropriation for that year. Going back to fiscal 1958, the figures indicate about the same pattern.

In addition, it might be pointed out that the Foundation initially requested $1,450,000 for its overall manpower program for fiscal 1960; eventually, however, the Foundation accepted the Budget Bureau's recommendations and cut this amount by 31 percent to $1 million, although not obliged to do so. In other words, reductions imposed by the Budget Bureau might have been applied to other areas of the Foundation budget.

In any event, the fact is that the National Science Foundation is putting less than 1 percent of its total budget into its register and manpower studies.

*Organizational setup*

Under the terms of its 1950 organic act [2] the National Science Foundation was directed to provide the following divisions as part of its internal organization: (*a*) a Division of Medical Research; (*b*) a Division of Mathematical, Physical, and Engineering Sciences; (*c*) a Division of Biological Sciences; and (*d*) a Division of Scientific Personnel and Education * * * *unless otherwise provided by its governing Board.* The Board was also authorized to establish "such other divisions" as it might find necessary.

At the present time the National Science Foundation is composed of (*a*) a Division of Biological and Medical Sciences, (*b*) a Division of Mathematical, Physical, and Engineering Sciences, (*c*) a Division of Scientific Personnel and Education, and four Offices—International Programs, Science Information Service, Social Sciences, and Special Studies. The Foundation's scientific manpower program has not attained the status of a division or an independent office. It is one of five programs operating under one of the three divisions, the Division of Scientific Personnel and Education.

Thus while the Foundation's governing body, the National Science Board, has seen fit to use its discretionary powers and depart from the statutory organization of the Foundation to some degree, it has not exercised this authority on behalf of the scientific manpower studies or the national register. These programs remain relatively obscure in the overall organizational scheme.

It should be noted further that testimony given the committee by Foundation officials has been to the effect that a staff of three professionals is employed to coordinate the register program and five professionals to coordinate the manpower studies. The bulk of the substantive work is done under contract.

## Evaluation of the Manpower Program

During the past several years, and particularly since the advent of the Space Age in the fall of 1957, there has been evidence of dissatisfaction with the Foundation's manpower programs. This concern has come from within the Foundation and without, from other Federal agencies, from private enterprise, and from the professional societies.

It has been charged, for example, that the register of scientists and technicians is too incomplete, too far behind time, and places too little emphasis on practical experience to be of broad value. It has been alleged that the manpower studies themselves, based on incomplete information, cannot provide adequate data for either current purposes or as a means of anticipating national scientific needs.

The year 1958—a time when the entire Government was in a state of intense scientific soul-searching due to sputnik and the International Geophysical Year—produced several specific studies dealing with the shortcomings of our scientific manpower tabulation efforts.

*The Gamble report*

One of these studies was completed in March 1958, by Dr. Allen O. Gamble, then Director of the Foundation's register and currently Chief, Examinations and Standards Division, National Aeronautics

[2] Supra, note 1, sec. 7.

and Space Administration. Dr. Gamble, who was brought before the committee as a witness, provided the following testimony regarding his study:

Mr. HALL. Doctor, while you were head of this register, did you make any recommendations for expanded services?

Dr. GAMBLE. I did, definitely.

Mr. HALL. What were those recommendations?

Dr. GAMBLE. My recommendations were in three parts or sections. The first five recommendations were aimed at increasing the technical capacity or competence of the register, in relationship to its goals and functions as established under law and as required to serve the national interest. They were as follows:

Recommendation 1: Expand input-processing facilities at the Register Records Center. The objective was to speed up and make more efficient such operations as checking incoming questionnaires, microfilming, card punching, reproducing, sorting, filing, et cetera, so as to eliminate the 2- to 3-year backlog, provide better mobilization readiness, and make manpower statistics more quickly available. Additional space, equipment, staff, and funds were requested in specific terms.

Recommendation 2: Install current-address system. The register depends on professional societies for addresses of their members, and the addresses of nonmembers are several years old in most cases. Current addresses are needed on a continuous basis for a variety of purposes including mobilization readiness, updating of substantive information, statistical studies in terms of geographical location, preparation of specialized directories, et cetera. Since mailing addresses of scientists change on the average about 30 percent a year, a real problem exists. A specific solution to the problem was developed and proposed, including optical scanning and other equipment, procedures, costs, and scheduling.

Recommendation 3: Develop and install systems of updating substantive information. This proposal was to modify the existing system of complete requestionnairing of scientists every 2 or 3 years, by separate treatment of three categories of information. Category I would include personal and historical information such as name, date of birth, sex, citizenship, and educational history. Such information, once incorporated into register files, normally does not change and should not be requested again from the scientist except to have him check it periodically. This would eliminate a source of justified complaints from scientists. Category II would include qualifications information such as field and specialties of primary competence, major professional functions, knowledge of foreign languages and areas, et cetera. Updating such information could be done every 2 or 3 years without great loss of accuracy, again reducing the load on the reporting scientist. Category III would be limited to employment information: employment status (full-time employed, student, et cetera), type of employer, locality of employment, employment specialty and function, and salary. This type of data changes quite rapidly. It should be updated at every change of address, otherwise at intervals of 6 months to 1 year, using a condensed type of checklist questionnaire. This proposal to treat the three categories separately was advanced as requiring some rather difficult technical development but little or no additional funds.

Recommendation 4: Develop improved classification of scientific and technical specialities. No present system of classification, including that of the register, is fully satisfactory for all of the purposes it must serve. A system should be developed which (*a*) is up to date, since the present system is a modification of the one developed in World War II; (*b*) covers all of science and technology; (*c*) is of reasonable length; (*d*) is flexible and expandable to accommodate future growth in any direction, including the unexpected; (*e*) is constructed in block or hierarchical form to allow different levels of fineness of treatment; (*f*) is compatible with other systems such as those of Census and Bureau of Labor Statistics, past and present, so as to allow studies of historical trends; and (*g*) has a coding scheme suitable for machine handling and is compatible with the preceding criteria. It was recommended that at least one full-time register staff member be appointed or assigned to this project. Incidentally, the register central staff consists of three professionals and two secretaries.

Recommendation 5: Develop methods for collecting and using qualitative information. This recommendation proposes that an intensive study be made of the difficult problem of measuring the quality or excellence of scientists and engineers. About a dozen possibilities were listed and discussed.

Action on the preceding five recommendations was proposed to be taken as the first step, in order to strengthen the register's technical capacity and competence.

The following seven recommendations were then intended to increase the active usefulness of the register and make it better known to the scientific and technical community, to users of register information, and to the Nation generally. One particular objective would be to provide feedback of useful service and information to registrants, in return for their work in providing information concerning themselves.

Recommendation 6: Expand output-processing capacity of the Register Records Center. This recommendation refers to statistical analyses of various types, IBM tape listings of specialized selected groups, production of mailing address labels for specialized groups and so forth. Although the register is the richest and in many ways the best source of information concerning the Nation's scientists, output of information has been slow and meager. Both equipment and staff have been badly needed.

Recommendation 7: Obtain authority for cost reimbursable operations. It was recommended that authority be obtained for the register to charge on a cost reimbursable basis for certain services rendered. Such charges would apply only to special purpose analyses of interest to a requesting individual or organization.

Recommendation 8: Provide selective mailing lists of registrants to qualified organizations. Once the register has become operational with its proposed current address system, recommendation 2, it is proposed that mailing lists be made available to Government agencies and nonprofit institutions. Use of such lists would probably be restricted to mailing notices of availability of technical information of interest to the particular selected list, such as translations of Russian documents in astronautics to specialists in space science. Each such mailing would be accompanied by two statements: (1) that the name and address had been furnished by the National Register; and (2) that, if the recipient objects to having his name and address so used, he should notify the register.

Recommendation 9: Make register information available for publication of special directories, jointly with professional societies. Once the proposed current address system is in operation, it would be technically easy for the register to sort special lists of scientists or engineers and produce condensed directories of specialists. Such directories could include all specialists in a narrow field of work, all in a given metropolitan area, and so forth. They could be issued within days of receipt of latest address, rather than the usual year or more for the typical specialized directory. They would facilitate intercommunication among scientists in the same specialty or area, or having the same language skills, and so forth, to the benefit of national progress in science. Safeguards would be used to prevent commercial exploitation, and the work would be done in cooperation with the professional societies.

Recommendation 10: Allow society placement services to use register information for referrals. This is a proposal for investigation of feasibility, followed by action if indicated. It would assist professional societies to use register information for peacetime placement operations, insofar as individual registrants agreed in writing, and would avoid the disadvantages of a Federal peacetime placement activity.

Recommendation 11: Intensify, broaden, and cross-check registration within present fields of coverage. This is a modest proposal—increase of 10 percent to 15 percent in grants to professional societies—to increase coverage in present fields of physical and life sciences. A variety of specific approaches is listed.

Recommendation 12: Conduct publicity and information campaign. If the register is to be a live and maximally useful organization, it must be known and understood by the population it covers, by the organizations it serves or will serve in peacetime or emergency, and by the Nation which supports it through tax funds. The better known the Register is, the higher the response rate to its questionnaires and the more useful its services can be. Several suggestions for action were outlined.

The above 12 recommendations concern operation of the Register within its present fields of coverage. All should take priority over expansion into new fields.

But as soon as significant progress on the preceding recommendations has been achieved or is well underway, the register should begin expansion into new fields of critical national importance. Among these are aeronautical and astronautical science, electronics and communications, metallurgy and ceramics, rockets and missiles, and so forth. Immediately thereafter, expansion should be extended into the other areas of engineering and technology.

*The Hauser report*

In August 1958, a special task force which had been instigated by the Executive Office of the President to study the broadgage problem issued a technical report of considerable scope. This was the so-called Hauser report (named for the task-force chairman, Philip M. Hauser of the University of Chicago). Entitled "A Program for National Information on Scientific and Technical Personnel," this report described its origin and mission as follows:

> The last few years have witnessed a sharp increase of interest in the twin subjects of science and scientific personnel. This growing concern has arisen from the intimate association of economic development and scientific advance, the recent high levels of economic activity, the growing complexity of national defense equipment, and the resulting shortages of scientific and technical skill. More recently, the remarkable advances in foreign scientific achievements have led to searching examination of our resources of scientific personnel, their training and professional characteristics, and probable future supply.
>
> Some recent Government programs dealing with scientific manpower may be cited as indicative of this growing interest. In 1956, the President's Committee on Scientists and Engineers was established to provide leadership for non-Government programs designed to improve the quality and increase the numbers of well-qualified scientists and engineers. In 1957, National Science Foundation programs for the improvement of science teaching were sharply expanded. In 1958, further sharp increases occurred in Foundation programs, and the administration proposed new programs in support of science education. In 1957 and 1958, both the Organization for European Economic Cooperation and the North Atlantic Treaty Organization adopted new programs to encourage member countries to review their scientific manpower situations and develop similar measures.
>
> Two developments occurring about this time are primarily responsible for this document. Early in 1957, the President's Committee on Scientists and Engineers found itself handicapped in its program development activities through lack of agreement on much of the basic statistical data relating to scientists and engineers. The Committee decided to establish a task force on statistics to evaluate existing data and propose methods of remedying deficiencies. An independent development in June 1957 was a request to the National Science Foundation by the Bureau of the Budget for the preparation of a program of collection of needed data on scientists and engineers.
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> The Budget Bureau's request stated in part:
>
> "We are accordingly requesting the National Science Foundation to develop a program for collection of needed supply, demand, employment, and compensation data with respect to scientists and engineers and for such other professional groups as it considers appropriate. Because of its functions, its relationship to the National Committee for the Development of Scientists and Engineers, and because it has already arranged for studies of employment in scientific fields, we believe the Foundation is the most logical agency to undertake such a task."
>
> The Foundation accepted this assignment and jointly with the President's Committee on Scientists and Engineers organized an Advisory Panel to review and evaluate the available information on the demand and supply of scientists, engineers, technicians, and teachers of science and engineering. The Panel was asked to recommend such inquiries or other measures as in its judgment would provide the additional information needed for policy formulation in the field of scientific and technical personnel.

The report was comprehensive and may have been especially helpful in pinpointing new problems arising in connection with modern scientific manpower research and in suggesting ways to overcome them.

*The Wolfle report*

The most recent important study of the problem, with specific reference to the operation of the manpower register, was conducted by a special Review Panel under the chairmanship of Dr. Dael Wolfle,

executive head of the American Association for the Advancement of Science.

The Review Panel was established on request by the National Science Foundation, whose officers apparently were not satisfied with results of the register up to that time. Findings of the Panel were reported to the Foundation in November, 1958. They were basic in nature and focused on policy considerations, as follows:

1. *The National Science Foundation should come to agreement on the purposes, policies, and scope of the register.*

In recommendation 2, the Review Panel submits its own recommendation concerning purposes, and in recommendation 5 its suggestions concerning scope. Whether or not these recommendations are adopted, it seems to the Panel essential that members of the NSF staff come to agreement, for there is considerable evidence that lack of clear agreement concerning the scope, function, and values of a register are in substantial part responsible for the fact that the register has now collected large masses of data but has relatively little of that data in usable form.

The number of people to whom questionnaires have been sent, the amount of information requested of respondents, and the forms in which records are expected eventually to be available, have been allowed to outrun the facilities available for processing the data. As a consequence, many addresses are out of date, data collected 2 or more years ago are not ready for tabulation and analysis, and neither the NSF nor the cooperating societies have been able to derive benefits from the register to the extent hoped for in its planning.

The Review Panel has some doubts concerning individual items of the method of operation. To cite a single example, at least some of the societies from which information was received do not feel any need to have window cards containing microfilm copies of the questionnaires since the original questionnaires are available and are easier to read. The Panel has agreed, however, that there is no point in discussing the details of space, machine, and personnel requirements and operational procedures at this time. Agreements on the more fundamental policy matters of function and scope should precede discussion of operating details.

2. *The Panel recommends that the two purposes to be emphasized in the register are (a) statistical studies of American scientists and their characteristics, and (b) the availability of names, addresses, and personal data for possible use under mobilization conditions.*

The Panel recognizes that there are other possible uses of a register; perhaps the outstanding one is for peacetime placement purposes. The Panel agrees with the NSF that this is not a proper function of the NSF. The Review Panel takes the position, however, that the cooperating societies should each be free to determine the extent to which it wishes to use its portions of the register for placement purposes.

Still other functions might be developed—for example, the printing of specialized directories. The Review Panel believes that all of these other purposes are of secondary importance, and should not be permitted to interfere with the achievement of the two principal functions.

The register can serve as a valuable source of data for the Foundation's clearinghouse of information function, and in like manner can be used by individual societies for studies of characteristics of the persons within the field of interest of those societies.

The usefulness of the register as a source of statistical data is limited by the fact that coverage is incomplete and by the fact that the register itself can never give information about the total population from which the register sample is drawn. Despite this limitation, the members of the Panel feel confident of their own judgment that rapid and prompt analysis and publication of statistical information from recently collected questionnaires would be of value to institutions and individuals interested in the trends and changing characteristics of America's scientific population. On this point we ask if the Foundation itself feels satisfied that its programs and its recommendations to Congress have been founded on as solid a basis of statistical information as is desirable.

With respect to the mobilization function, the Panel suggests the desirability of securing from the Office of Civil and Defense Mobilization and other potential mobilization users, information concerning the questions that are likely to be

asked of the register and how the register information would be likely to be used under mobilization conditions. The concept of national mobilization has changed drastically during the past dozen years; the experience of World War II and the Korean war probably no longer provide the only good models of what to expect in the future. The Department of Defense, the Office of Civil and Defense Mobilization, and other defense agencies cannot, of course, state in detail all of the eventualities, but must envision various degrees of national emergency. Yet it would be of very great help in register planning to secure from these agencies information concerning the kind of data that would be needed to answer their mobilization requirements, the degree of detail of information about any individual that would be wanted from the register, which would probably vary for different types of individuals, and the ways in which register information would be likely to be used. The Panel recommends that defense agencies be asked to study these matters and to advise the Foundation.

3. *The Panel recommends that all reasonable efforts be made to get the present data in usable form.*

Although much of the data are of reduced value now, analysis of the 1954 and 1956 questionnaires will be of historical interest and will help to determine trends.

4. *The Panel recommends that all reasonable efforts be made to bring the data on present registrants up to date.*

"Up to date" means accurate current addresses, deletion from the register of deceased registrants, addition of potential registrants who have become eligible since the initial data collection, and the correction of major items of information, such as position, responsibilities, degrees, and so on, that have changed since the time of initial data collection.

5. *The Panel recommends that there be no expansion of scope of services of the register until after the above recommendations have been carried out.*

In operating its other programs, we believe that the National Science Foundation itself does not now get from the register the data that it would find useful. This is equally true of Congress and the executive branch as well as educational institutions, scientific societies, and the scientific population at large. Only after the above recommendations have been carried out will there be available a usable register. After a usable register is in existence, the Foundation and other interested agencies will be in a position to assess its value and to make reasonable estimates of the value of contemplated expansions of coverage, services, and amount of information.

6. *In future register operation, the Panel recommends that much greater emphasis be placed upon speed, even if that emphasis requires some sacrifice of detail or completeness of coverage.*

In at least one instance, a cooperating society punched its own deck of cards before shipping the questionnaires to the Foundation. From the cards so punched the society has been able to obtain a considerable amount of useful and timely information. This is, of course, only one way in which the process of data collection, tabulation, and analysis can be speeded up. The Panel recommends that all feasible means of speeding up the operation be adopted. The mobilization function will be better served by having an accurate and up-to-date even though incomplete, register than by having a complete register in which a large but unknown amount of the information is inaccurate and out of date. For the purpose of statistical studies, it will be of greater interest and value to the scientific community to have current information on a sample than to have information on the entire population that is several years out of date.

In summary, the Review Panel recommends that special efforts be made to put the already collected information into usable and up-to-date form so that the Foundation and others will have an opportunity to assess the value of an actual functioning register. The Panel further recommends that the staff of the Foundation come to agreement upon basic register policies with respect to scope and purpose. The Panel recommends that until these two steps have been

carried out, plans for extending the scope or enlarging the function of the register be held in abeyance.

IRA H. ABBOTT,
*National Aeronautics and Space Administration.*
HENRY A. BARTON,
*American Institute of Physics.*
ALBERT KAY,
*Department of Defense.*
MILTON O. LEE,
*Federation of American Societies for Experimental Biology.*
RAY W. MAYHEW,
*Owens Illinois Glass Co.*
HARRY A. WINNE,
*General Electric Co.*
DAEL WOLFLE,
*AAAS, Chairman.*

One member of the Panel (Lee) is strongly of the opinion that the scope of the register should be narrowed. This might be accomplished either by division of the present register into two completely separate portions, a "Register of Scientific Personnel" and a "Register of Technical Personnel," or by amendment of the act creating the NSF to eliminate "technical personnel." The first alternative would seem to be preferable at the present, since it would involve only an administrative policy and division, and would allow opportunity to determine how well a register of scientists only might serve. Determination of qualifications for inclusion as a "scientist" should be left to each of the cooperating organizations, with only a broadly guiding rule such as possession of a doctoral degree or its equivalent. Emphasis should be placed first on the "Register of Scientific Personnel," and it should be completed and made functional before much effort was directed to the "Register of Technical Personnel."

*Foundation's future course*

In rounding out the major details of the record, it is noted that following the introduction of H.R. 7981 by Representative Overton Brooks on June 26, 1959, the Foundation issued a public statement designed to clarify its future course in the manpower study field.

The text of this statement, released July 6, 1959, follows:

FOUNDATION ACCEPTS RESPONSIBILITY FOR PROGRAM OF NATIONAL DATA ON SCIENTIFIC AND TECHNICAL PERSONNEL

The National Science Foundation, an independent agency of the U.S. Government, announced today that at the request of the Bureau of the Budget it is accepting leadership in behalf of interested Federal agencies for establishing and maintaining a program of national information on scientific and technical personnel.

The Bureau recently circularized several interested Government agencies to learn their views as to the importance of adequate statistical information on scientific personnel; their training and utilization, compensation levels, supply and demand, and other related data. Agencies were asked to comment on the report of the Foundation, "A Program for National Information on Scientific and Technical Personnel." As a result of the agencies' replies, the Bureau asked the Foundation to take responsibility for a Federal program in this area "so that a coherent body of timely information can be built up on the supply, demand, and utilization of scientists and technical personnel."

The Bureau noted that "leadership in planning, coordinating, and analyzing information on scientific and technical personnel—and for assuring that the findings will be made public—would come from the National Science Foundation. In exercising these responsibilities, the Foundation should use the facilities of other Federal statistical agencies, where appropriate, to the fullest extent possible.

"Much of the information recommended will be produced by extending existing statistical series to identify scientists and engineers or to add items of information. Other projects will have to be initiated to meet the objectives of the program, but questions of coverage, timing, definitions, etc., should be considered in relation to the program as a whole. Existing statistical activities of a number of Government agencies are involved, especially those in the Departments of Commerce, Labor and Health, Education, and Welfare."

The decision of the Bureau to ask the Foundation to accept responsibility for guiding development of a program of national information on scientists and engineers arose from recent recommendations of an Advisory Panel on Scientific Manpower Data Requirements, convened to develop a coordinated plan for statistics on scientists and engineers. Members of the Panel were: Philip M. Hauser (chairman), University of Chicago; Philip H. Coombs, Fund for the Advancement of Education; Henry David, National Manpower Council; Coleman R. Griffith, American Council on Education; Merriam H. Trytten, National Academy of Sciences-National Research Council; Ralph J. Watkins, Brookings Institution; and Dael Wolfle, American Association for the Advancement of Science.

The panel recommended a program of 15 projects and designated the following 3 as most urgent:

1. *Identification of scientific and technical occupations.*—Analysis of work content and job descriptions in scientific, technical, and related fields, to develop methods for identifying these occupational categories with adequate precision when conducting such surveys.

2. *Pool of scientific and technical personnel.*—A periodic survey, using appropriate sampling techniques, of organizations and agencies of all types which are employers of scientific and technical personnel, to obtain information on the numbers and characteristics of such personnel.

3. *Periodic study of the demand outlook for various categories of scientific and technical personnel in each major activity.*—The study would include analysis of (*a*) employment and production growth trends; (*b*) the changing roles of particular classes of scientific and technical personnel, to develop current estimates and forecasts of demand for such personnel by occupation and educational levels.

## FINDINGS

(1) In 1950, when it established the National Science Foundation, Congress provided the Foundation with eight basic functions. Four of these were either ad hoc or general responsibilities. Four appeared to require the operation of specific continuing programs. The requirement that the Foundation—

> maintain a register of scientific and technical personnel and in other ways provide a central clearinghouse for information covering all scientific and technical personnel in the United States, including its Territories and possessions [3]—

was one of the four specific jobs which Congress directed the Foundation to undertake.

(2) It is recognized that the foregoing directive is a difficult one to satisfy. Rapid changes in the scientific world, in scholastic practices, in modes of formal training, in shifting work locales, and in the various facets of a scientist's continuing experience make the tabulation and study of such personnel a somewhat mercurial task—hard to perform with speed and accuracy. It is worthy of note that America's major scientific rival, the Soviet Union, is reported as having similar difficulties even with the Soviet system of work assignments which lends itself to registration much more readily than does our system. Information provided the committee, however, indicates that the Soviet Union—by creating the Scientific Economic Council in the U.S.S.R. Council of Ministers in February 1959, and assigning it the task of coordinating all registries of scientific workers—is giving high priority to this problem. We cannot afford to do less.

(3) It is recognized that a number of studies and reviews of the National Science Foundation's manpower programs have been or are being made, that some of these studies are on an interdepartmental basis, and that since 1953 the Foundation has had the continuing advice and help of a government-industry-professional Advisory Committee on Scientific Manpower Information. It is the committee's

[3] Supra, note 1, sec. 3(*a*) 8.

view, however, that, from the standpoint of legislative oversight, none of the critical reviews of the manpower programs has been of a nature to provide Congress with the picture it needs to assure the maintenance of an efficient register and meaningful manpower surveys.

(4) The National Science Foundation has been operating its manpower program on a conservative basis. The Foundation's officers have assured the committee that this has been necessary in order to arrive at a system, economically and practically, which will not be obsolete or insufficient by the time it is set up. Other witnesses have testified to the contrary and have implied that the Foundation is a victim of its own caution, that its manpower programs are made ineffective thereby. The committee inclines toward the latter view.

(5) The committee acknowledges that the National Science Foundation "at the request of the Bureau of the Budget" is now "accepting leadership in behalf of interested Federal agencies for establishing and maintaining a program of national information on scientific and technical personnel." The Foundation so announced on July 6, 1959.[4] The committee lauds the Foundation's decision. The committee, however, is at a loss to understand how the Foundation can "accept leadership" of a program at the instance of an executive agency when it was directed to do so by the Congress 9 years earlier. The committee is further mystified by this announcement insofar as it indicates that an entire year passed following the recommendations of the Advisory Panel [5] before the Bureau of the Budget determined to make such a request and insofar as the record discloses that the Bureau had already made a similar request in June of 1957, two years before.

(6) Testimony provided the committee by officers of the National Science Foundation clearly shows that the Foundation itself is making no claim that its manpower programs are adequate or that there is any possibility of attaining an up-to-date register as contemplated by the Congress in the immediate future.[6]

(7) The committee believes that the summary provided in the report of the Review Panel [7] is very revealing. That summary commented:

> The Review Panel recommends that special efforts be made to put the already collected information into usable and up-to-date form so that the Foundation and others will have an opportunity to assess the value of an actual functioning register. The Panel further recommends that the staff of the Foundation come to agreement upon basic register policies with respect to scope and purpose. The Panel recommends that until these two steps have been carried out, plans for extending the scope or enlarging the function of the register be held in abeyance.

Thus it is patent that the register, as viewed by the Panel in November 1958, could not then provide usable information and that the Foundation was experiencing internal disagreement over various phases of operating it. Foundation witnesses have testified that this situation is improved, but the committee has no reason to believe it has been erased.

(8) The committee admires the thrift of the National Science Foundation in operating its manpower programs on a relatively small budget and with a minimal staff. The committee has no desire to promote the unnecessary or ineffective expenditure of funds. Never-

[4] Supra, p. 15.
[5] Supra, p. 12.
[6] Scientific Manpower and Education, hearings before the Committee on Science and Astronautics, 86th Cong., 1st. sess., pp. 327–360.
[7] Supra, p. 12.

theless the committee is inclined to believe, in view of the statutory importance attached to these programs, that the Foundation's current policy of devoting less than three-tenths of 1 percent of its budget to the scientific register and only six-tenths of 1 percent to its entire manpower program suggests an unwarranted lack of emphasis in this area.

(9) From the foregoing it is apparent that Congress' 1950 directive, which requires the National Science Foundation to develop informational programs covering *all* the Nation's scientific and technical personnel has not been adequately met as of this date.

(10) Meanwhile, with the Space-Atomic Age upon us and with the need for scientific manpower growing daily, the need for a superior manpower tabulation is likewise accelerating rapidly. It must also be kept in mind that America's stature in the international community is becoming increasingly dependent upon her scientists, engineers, and technicians. Knowing who they are, where they are, and what they can do is thus becoming crucial.

## Recommendations

The committee recommends:

(1) That the executive branch of the Federal Government, as a whole, lend its aid and influence to help assure that the study requested by the committee,[8] for submission by the opening of the next session of the Congress, will contain all relevant views and indicate where legislative action may be of most value.

(2) That the National Science Foundation seriously and carefully scrutinize its total mission, budget, and organizational structure to ascertain if more emphasis may not profitably be given to its scientific manpower programs.

(3) That the National Science Foundation and its advisory groups not permit themselves to be overly deterred from prompt and vigorous action by the shifting scientific scene. Events of the past decade indicate that this situation will not only continue but become more acute. The objectives of the manpower program and the means of reaching them should be decided upon forthwith, even at the risk of some mistakes, and immediate steps taken to implement the decision.

## Conclusion

The committee acknowledges that in this complex matter it does not have sufficient information or background to make more specific recommendations or sponsor helpful legislation at the present time. The committee is not now critical, nor does it wish to appear so, of the conduct of the manpower programs within the administrative limitations imposed upon them. The committee does believe that the programs have been unduly slow in developing. It is the hope and intent of the committee, by its action here, to encourage and promote all appropriate Government agencies in their efforts to improve surveillance of the Nation's scientific and technical manpower.

[8] Supra, p. 2.

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